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Nasser-Faili

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(54) **SEMICONDUCTOR DEVICE STRUCTURES COMPRISING POLYCRYSTALLINE CVD DIAMOND WITH IMPROVED NEAR-SUBSTRATE THERMAL CONDUCTIVITY**

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See application file for complete search history.

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(57) **ABSTRACT**

Disclosed is a semiconductor device structure including a III-V compound semiconductor material layer, a polycrystalline CVD diamond material layer, and an interface region, having a diamond nucleation layer, between the III-V compound semiconductor material layer and the polycrystalline CVD diamond material layer. A Raman signal generated from a region having the diamond nucleation layer exhibits an sp3 carbon peak at 1332 cm^{-1} having a full width half-maximum of no more than 5.0 cm^{-1}. The Raman signal further exhibits one or both of the following characteristics: (i) an sp2 carbon peak at 1550 cm^{-1} having a height no more than 20% of a height of the sp3 carbon peak; and (ii) the sp3 carbon peak at 1332 cm^{-1} is no less than 10% of local background intensity. The diamond nucleation layer further includes an average nucleation density range of 1×10^{8} cm^{-2} to 1×10^{12} cm^{-2}.

9 Claims, 7 Drawing Sheets